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Device for communication in and control of a yarn processing system

The present invention relates to a device for communication in and control of a yarn processing system (see the enclosed Figure), comprising a textile machine (M), e.g. a weaving machine and one or several yarn feeding devices (F1 – Fn), e.g. weft yarn prewinders, each of which can have associated accessory means (not shown here), like for example controlled tensioners, yarns sensors, etc. The textile machine includes a main control and each yarn feeding device includes a feeder control for itself and possibly also for its accessory means. According to the state of art, there is furthermore provided a serial communication-fieldbus system (FB), including one or several bus line(s), by which fieldbus system at least all respective feeding device controls of said yarn feeding devices (F1 – Fn) are connected to the main control of the textile machine, forming a communication network with a type of lay-out called "T-connector" (shown in the Figure), or "Daisy-chain" type (not shown here).

The object of the present invention is to achieve a device, by which it is possible to optimize the definition, and security of the transmission of time-specific and time-critical messages in such a yarn processing system and to simplify the synchronisation between the various units and components in the system. In the case of said textile machine being an airjet weaving machine, such time-critical messages could be the trig signals from the weaving machine to the yarn stopping device in each measuring yarn feeder in the system. Another example in that case is the so called "winding pulses" from the yarn withdrawal sensor in the respective feeder to the weaving machine. In the case of a rapier or projectile weaving machine, such time-critical messages could be the trig signals for controlling the respective controlled yarn tensioner (feeder accessory) on the output side of each yarn feeder.

According to the enclosed claim 1, this invention proposes to meet this object mainly by the fact that there beyond said fieldbus system (FB) is provided one or several specific event-synchronous line(s) (EL) as function for bidirectional digital signal transmission between the textile machine (M) and the yarn feeding device(s) (F1 – Fn) of messages of time-critical or time-specific character, so called event-synchronous signals, being for example trig signals for initiating or carrying out certain predetermined functions in the yarn feeding devices and its accessory means, respectively in the textile machine, and/or being feed-back signals, e.g for confirma-

tion of initiated, carried-out functions or events, indication of status of specific conditions, functions or components comprised in the yarn processing system, etc.

In a preferred embodiment of the device according to the invention, the actual function of said event-synchronous line or lines (EL) with respect to time, i.e. its intended function in a certain point of time or in a certain time period, which function e.g. can consist of information about the actual type of next-coming event being sent on said specific line or lines and of address information as to or from which node or nodes (feeding device(s)/accessory(ies) (F1 – Fn) the next-coming event signal is associated, is definable or configurable, preferably on a continuous time basis, by means of serial-type information being sent on said serial field-bus(es) (FB) connected between the machine (M) and the feeding devices (F1 – Fn), and their accessories (if any).

In other words, the field-bus is used to "dedicate" the event line(s) for a certain function and is able to continuously change or successively "update" this function dedication in an easily controllable manner over the field-bus, whereby the consequence will be that the event line always is "ready" to immediately transmit any existing time-critical signal precisely in the moment when it is needed; thus, a fully "time-safe" control of the system has been accomplished.

Thus, the event line (or lines) (EL) in the system is (resp. are) a bidirectional, direct digital line (lines) with the purpose to transmit event-indicating pulses, which in the preferred embodiment are definable by means of serial communication of information over the field-bus system (FB). The bidirectionability means that any node in the system can use the event line both to send event signals and to receive (read) event signals.

Furthermore, in the preferred solution embodiment, the "function" of the respective event line (EL), which thus "varies" over time, is defined, or so to speak configured, via or by means of the serial communication field-bus system (FB), which for example can be a CAN-bus, ruled by a CAN protocol. This means that the field-bus will contain serial-type information about the type of the next-coming event showing up on the event line or lines and also information about which specific node or nodes that particular event signal is intended for or will be coming from. In another case, the field-bus could indicate a number of events to be used by one or more nodes, and in yet another case the field-bus could define a number of events

coming during a certain, subsequent (following) certain period of time (or until a new, function definition is made, which then will override (replace) the previous definition)..

The communication system structure according to the invention thus enables that the function of the event line is configurable and changeable during running of the textile machine. The possible delay time of the event signals (pulses) could be defined and calculated in advance when defining the system.

Furthermore, the connection structure of the event line or lines is either so called "point to point", which means, hardware-wise, that there has to be provided one "event-signal-driver" (ELD) and one event-line (EL1 – Eln) connected to each feeding device (F1 – Fn), or so called "multi-drop", which means that only one "event-signal-driver" is needed, together with only one event line, to which all feeding devices (F1 – Fn) are connected (structure shown in the Figure).

As an example of an application of the event signal line according to the invention, the following case could be described:
As mentioned above, in the case of an airjet weaving machine it is time-critical for the weaving machine to start the yarn withdrawal, monitor the number of withdrawn yarn windings and then to stop the yarn withdrawal in each respective yarn feeder at the exactly right moment in time This could be implemented in the following way:

1) First, the weaving machine sends a message on the field-bus (e.g. CAN-bus), which dedicates the event line for a trig signal. This means that the next signal showing up on the event line will be a trig signal for a certain event;
2) In the next moment, the next CAN message being sent defines a specific feeder, let us say F3, in the system to order the solenoid to lift the yarn stopping pin x milliseconds counted from the occurrence of the next signal showing up on the event line (which thus will be a trig signal according to 1) above;
3) When said trig signal shows up on the event line, the "event" or function according to 2) will be carried out when said x milliseconds have passed;
4)The next CAN message dedicates the event line for winding pulses from a specific feeder (F3); the feeder can then use the event line to send the winding pulses, which will be monitored by the main control of the weaving machine;

5) After all correct number of winding pulses from feeder F3 have been monitored, a CAN message dedicates the event line for a ~~"new"~~ trig signal;

6) The next CAN message defines feeder F3 to carry out the lowering (closing) of the yarn stopping pin y milliseconds counted from the occurrence of the next signal showing up on the event line (which will be a ~~trig~~ signal according to 5);

7) In the very next moment, the control in feeder F3 "reads" the trig signal showing up on the event line, whereby the yarn withdrawal will be stopped in accordance with the conditions defined in 6) above, that is when y milliseconds have passed. One cycle of weft insertion (pick) has now taken place in a correct, time-safe way.

The present invention is not limited to the embodiments and examples descrived in the above, but several variations are possible within the scope of the invention thought.

CLAIMS

1. Device for communication in and control of a yarn processing system, comprising a textile machine (M), e.g. a weaving machine and one or several associated yarn feeding devices (F1 – Fn), e.g weft yarn prewinders, each of which can have associated accessory means, like for example controlled or uncontrolled yarn tensioners, yarn sensors, etc., said textile machine including a main control and each said yarn feeding device including a feeder control for itself and possibly also for its accessory means , further comprising a serial communication field-bus system (FB), including one or several parallel bus line(s), by which field-bus system at least all respective feeding device controls of said yarn feeding devices are connected to the main control of said textile machine, characterized in that there beyond said field-bus system (FB) is provided one or several specific event-synchronous line(s) (EL) as function for bidirectional digital signal transmission between said textile machine (M) and said yarn feeding device(s) (F1 – Fn), and vice versa, of messages of time-critical or time-specific character, so called event-synchronous signals, being for example trig signals for initiating or carrying out certain functions, certain feed-back pulses, e.g. for confirmation of said initiated or carried-out functions, (for indicating) or events, occurring in the ~~indication of status of specific conditions, functions or~~ components comprised in said yarn processing system, etc.

2. Device according to claim 1, characterized in that the ~~actual~~ function of said event-synchronous line or lines (EL) with respect to time, i.e. its intended function in a certain point of time or in a certain time period (time window) - which e.g. can be information about the type of next-coming event signal being sent or showing up on said specific event line or lines and/or of address information as to (or from) which node or nodes of said feeding device(s) (F1 – Fn)/accessory(ies) said next-coming event is associable - is definable or configurable, preferably on a continuous time basis, by means of information being sent on said serial field-bus system (FB) (connected) between the textile machine and the feeding devices, and their accessories (if any).

Abstract

Device for communication in and control of a yarn processing system, comprising a textile machine (M), e.g. a weaving machine and one or several associated yarn feeding devices (F1 – Fn), e.g weft yarn prewinders, each of which can have associated accessory means, like for example controlled or uncontrolled yarn tensioners, yarn sensors, etc., said textile machine including a main control and each said yarn feeding device including a feeder control for itself and possibly also for its accessory means , further comprising a serial communication field-bus system (FB), including one or several parallel bus line(s), by which field-bus system at least all respective feeding device controls of said yarn feeding devices are connected to the main control of said textile machine, c h a r a c t e r i z e d in that there beyond said field-bus system (FB) is provided one or several specific event-synchronous line(s) (EL) as function for bidirectional digital signal transmission between said textile machine (M) and said yarn feeding device(s) (F1 – Fn), and vice versa, of messages of time-critical or time-specific character, so called event-synchronous signals, being for example trig signals for initiating or carrying out certain functions, certain feed-back pulses, e.g. for confirmation of said initiated or carried-out functions, (for indicating) or events, ~~indication of status of specific conditions, functions or~~ occurring in the components comprised in said yarn processing system, etc.

Figure